

TWO NEW SPECIES OF *DIPLOCENTRUS* (SCORPIONES: DIPLOCENTRIDAE) FROM MEXICO¹

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ABSTRACT: Two new species of the genus *Diplocentrus* from Mexico are described, illustrated, and compared to related taxa and others in their respective geographical areas. *Diplocentrus ferrugineus* occurs in northeastern Mexico in the southern part of Nuevo León, and *D. coylei* is found in southern Mexico in the northwestern part of Guerrero. Two new records for *D. colwelli* in Nuevo León are also reported.

The genus *Diplocentrus* is proving to be one of the most diverse elements of the Mexican and Central American scorpiofauna. Of the thirty species currently recognized as valid, twenty-two have been reported to occur in Mexico. It is evident from ongoing research that many new species remain to be described. This is particularly true for western Mexico, where in certain states no records of the genus exist. Although the diplocentrid fauna of northeastern, central, and southern Mexico (including Yucatan) seems fairly well known, it is clear from closer examination that sampling even in these areas is still largely incomplete. Consequently, it is not possible at this time to provide an accurate estimate of the total number of species in this genus.

It is the purpose here to describe two new forms, one from northeastern Mexico and the other from southern Mexico, based on specimens originating from the American Museum of Natural History (New York), the Louisiana State University Museum of Zoology (Baton Rouge), and the Museum of Comparative Zoology (Harvard University, Cambridge, MA).

Diplocentrus ferrugineus, NEW SPECIES

(Figs. 1-7)

Type Data. - Adult holotype male from 2.7 mi N and 2.4 mi SE La Ascension on La Caballada Rd., Nuevo León, Mexico on 19 July 1975 by E. A. Liner; deposited in the Florida State Collection of Arthropods, Gainesville.

Etymology. - The specific epithet is based on the Latin word, *ferrugineus*, for "rust-colored", which refers to the base coloration of this species.

Distribution. - Known only from southern Nuevo León, Mexico.

Comparative Diagnosis. - Currently, three other species of *Diplocentrus* are known from northeastern Mexico: *D. colwelli* Sissom, *D. diablo* Stockwell & Nilsson, and *D. whitei* (Gervais).

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Diplocentrus colwelli was described from the mountains in the Monterrey area in central Nuevo León (Sissom 1986) and is closely related to the new species. *Diplocentrus ferrugineus* is larger, with adults exceeding 40 mm in length (the 40-mm female paratype is probably subadult); adults of *D. colwelli* are less than 40 mm long (the paratype female reported at 44 mm long is almost certainly referable to *D. ferrugineus*; see "Comments" below). The pedipalp chela palms of male *D. ferrugineus* are weakly reticulate with the reticulations primarily limited to the dorsal face; in *D. colwelli*, both the dorsal and external faces of the palms are strongly reticulate. Morphometric differences in chela proportions between the two species are also conspicuous: In *D. ferrugineus*, the male chela is more slender (chela length/depth ratio is 2.19-2.28, compared to 1.78-1.88) and the chela fingers in both sexes of *D. ferrugineus* are longer (male fixed finger length/carapace length 0.77-0.88 in *D. ferrugineus*, 0.62-0.68 in *D. colwelli*; female ratios 0.65 in *D. ferrugineus*, 0.56 in *D. colwelli*).

Diplocentrus diablo is known from the southeastern Rio Grande Valley in Texas and in neighboring Tamaulipas (Ciudad Camargo) in Mexico (Stockwell & Nilsson 1987). The two species are approximately the same size, but *D. ferrugineus* is light-colored (orange-brown) whereas *D. diablo* is dark brown. *Diplocentrus ferrugineus* further differs from it by having lower pectinal tooth counts (9-11 in males and 8-9 in females, rather than 12-14 and 9-11, respectively) and a higher modal tarsomere II spine formula (5/5: 6/6: 7/7: 7/7-8, rather than 4/4: 4/5: 5/6: 5/6). The male pedipalps are distinctly more slender in *D. ferrugineus*, with chela length/depth ratios of 2.19-2.28 (rather than 1.86-2.00); morphometrics of the female chelae in the two species are similar. Finally, the reticulations on the male chelae are very weak in *D. ferrugineus*, but are pronounced in *D. diablo*.

Of the three species listed above, *Diplocentrus whitei* is the least similar to *D. ferrugineus*. Perhaps the only possible confusion in making identifications could be with juveniles of *D. whitei*. *Diplocentrus whitei* is a large dark species with adult size to about 70 mm. It has higher pectinal tooth counts (16-20 in males and 14-18 in females) and higher tarsomere II spine counts (6/7: 6/8: 7/8: 7/8); neither character exhibits age-specific variation so they will be useful in separating all age groups of the two species.

Description. - Based on holotype male.

Coloration: Base color of dorsum orange brown with faint dusky pattern; metasomal segment V and telson dark orange brown. Pedipalp chela reddish orange proximally, dark orange brown distally with fingers infuscate. Proximal segments of legs yellow brown, tarsi yellow. Venter light yellow brown. Cheliceral manus yellow brown with faint dusky pattern distally; cheliceral teeth dark reddish brown.

Prosoma: Anterior margin of carapace moderately, coarsely granular (Fig. 1); remainder of carapace smooth to finely granular, lustrous. Sternum with single anteromedian seta and eight additional pairs of setae.

Mesosoma: Tergites finely granular, interspersed with sparse coarse granulation posterolaterally. Tergite VII weakly bilobed, moderately granulose posterolaterally. Genital operculum moderately setose throughout; pectinal tooth count 11-11. Sternites III-VI smooth, lustrous, moderately setose. Sternite VII with submedian carinae vestigial, weak, and smooth; lateral carinae weak, smooth.

Metasoma: Segments I-IV: Dorsolateral carinae on I-III moderate to strong, irregularly granulose; on IV moderate, irregularly granular. Lateral supramedian carinae on I-III strong to moderate, irregularly granular; on IV moderate, smooth. Lateral inframedian carinae on I weak,

irregularly granular; II-III weak, granular; on IV vestigial, weak, smooth. Ventrolateral carinae on I-II strong, irregularly crenulate; on III moderate, irregularly granular; on IV moderate, slightly granular. Ventral submedian carinae on I-II strong, irregularly crenulate; on III weak, granular; on IV vestigial, weak, smooth. Segment V (Fig. 2): Dorsolateral carinae moderate, slightly granular. Lateromedian carinae vestigial, feeble, smooth. Ventrolateral, ventromedian, and ventral transverse carinae strong, with distinctly enlarged subconical granules. Ratio of segment II length/width = 1.09; III length/width = 1.31; segment V length/width = 2.57.

Telson (Fig. 2): moderately setose.

Chelicerae: Movable finger distinctly shorter than manus length; fixed finger distinctly shorter than manus width.

Pedipalps: Trichobothrial pattern Type C, orthobothriotaxic (Vachon 1974). Femur (Fig. 3): Dorsal and internal faces moderately granular. Dorsointernal carina strong, granulose; ventrointernal carina vestigial, strong, granulose on anterior half; dorsoexternal carina moderate, irregularly granular; ventroexternal carina vestigial, smooth on posterior half. Ratio of femur length/width = 2.52. Patella (Figs. 4-5): Dorsointernal carina strong, smooth; dorsal median carina faint, smooth; dorsoexternal carina weak, smooth; ventroexternal carina moderate, smooth; ventrointernal carina strong, smooth. Internal face with basal tubercle bearing three large granules. Dorsal face faintly, smoothly reticulate. Ratio of patella length/width = 2.62. Chela (Figs. 6-7): Dorsal marginal carina strong, irregularly granular; dorsal secondary carina weak, smooth; digital carina strong, smooth; external secondary carina moderate, smooth; ventral external carina vestigial, weak at movable finger condyle, smooth; ventromedian carina strong, smooth; dorsointernal carina weak, smooth basally with a few granules by fixed finger; ventrointernal and internal secondary carinae moderate, smooth. Dorsal face of manus feebly, smoothly reticulate. Ratio of chela length/depth = 2.24; of fixed finger length/carapace length = 0.88; movable finger length/chela depth = 1.60.

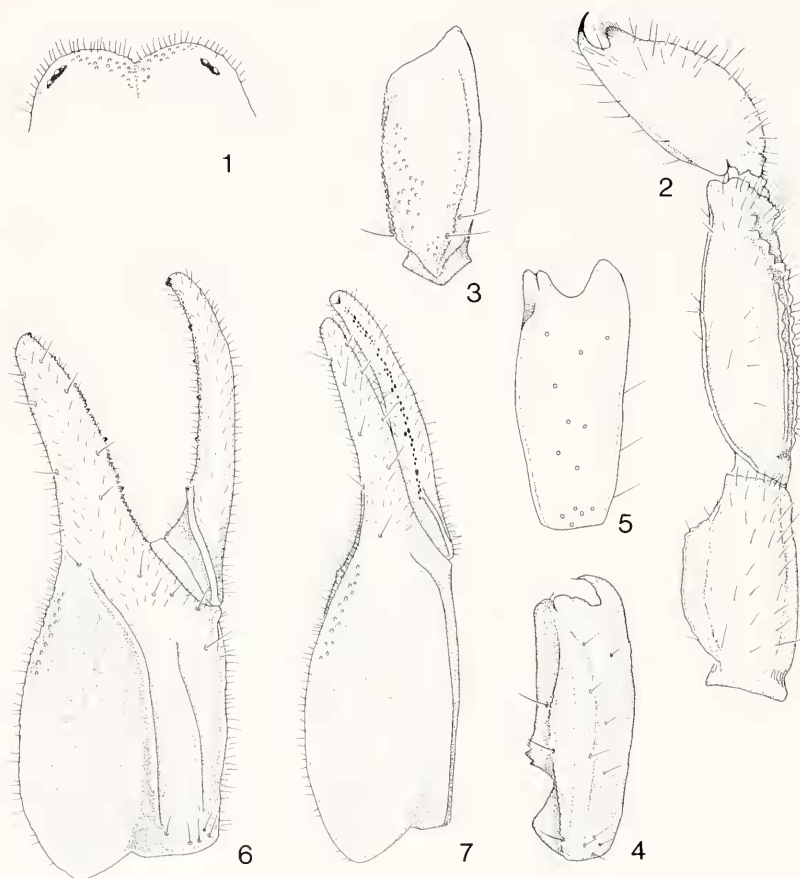
Legs: Tarsomere II spine formula 5/5 3/3: 6/7 5/6: 7/7 7/7: 7/7 7/7.

Variation. - The other males are about 10% smaller than the holotype in various body dimensions, but otherwise do not differ significantly. The female is similar to the male except in the following characters: (1) the metasomal and pedipalpal segments are proportionately shorter (Table 1); (2) metasomal inframedian carinae are stronger; (3) the carinae of the pedipalp chelae are weak to obsolete, and their dorsal faces bear only faint reticulations; and (4) the pectinal tooth counts are lower (see below). As is typical of *Diplocentrus* spp., the young specimens are uniformly pale yellowish in coloration and have rudimentary carination.

Variation in pectinal tooth counts is as follows: in males there were three pectines with 11 teeth, two with 10 teeth, and one with nine teeth; in females there were two pectines with nine teeth and two with eight. Morphometric variation is summarized in Table 1, and variation in tarsomere II spine formulas is presented in Table 2.

Measurements. - Holotype male (in mm): Total L, 46.4; carapace L, 5.8; mesosoma L, 14.4; metasoma L, 21.0; telson L, 5.2. Metasomal segments: I L/W, 3.2/3.4; II L/W, 3.6/3.3; III L/W, 3.8/2.9; IV L/W, 4.5/2.7; V L/W, 5.9/2.3. Telson: vesicle L/W/D, 4.2/2.3/2.0; aculeus L, 1.0. Pedipalps: femur L/W, 5.3/2.1; patella L/W, 5.5/2.1; chela L/W/D, 10.1/2.8/4.5; fixed finger L, 5.1; movable finger L, 7.2.

Paratype female (in mm): Total L, 40.0; carapace L, 5.5; mesosoma L, 13.5; metasoma L, 16.6; telson L, 4.4. Metasomal segments: I L/W, 2.5/3.2; II L/W, 2.8/2.8; III L/W, 3.0/2.8; IV L/W, 3.6/2.7; V L/W, 4.7/2.3. Telson: vesicle L/W/D, 3.5/2.5/1.9; aculeus L, 0.9. Pedipalps: femur L/W, 4.0/1.8; patella L/W, 4.1/1.9; chela L/W/D, 8.7/3.1/4.3; fixed finger L, 3.6; movable finger L, 5.2.



Figs. 1-7. Morphology of *Diplocentrus ferrugineus*, new species. All figures are of holotype male. 1, anterior portion of carapace, dorsal aspect; 2, lateral aspect of metasomal segments IV, V, and telson; 3, dorsal aspect of pedipalp femur; 4, dorsal aspect of pedipalp patella; 5, external aspect of pedipalp patella; 6, external aspect of pedipalp chela; 7, dorsal aspect of pedipalp chela..

Comments. - The paratype female of *D. colwelli* from Cerro Potosí in southern Nuevo León is almost certainly referable instead to *D. ferrugineus*. Unfortunately, the specimen could not be located in the California Academy of Sciences (D. Ubick, personal communication), where it was presumably deposited, so it could not be reexamined. In the description of *D. colwelli* (Sissom 1986), it was noted that the Cerro Potosí female, at 44 mm, was larger than the other adult female of *D. colwelli* and that the dorsal margin of its pedipalp chela was virtually smooth (not granulose). These characters are consistent with female characters in *D. ferrugineus*, based on information available from the single subadult specimen studied herein. Morphometrically, the Cerro Potosí female is closer to *D. ferrugineus* as well, particularly in the following ratios: Chela length/depth = 1.96 (reported as chela length/width in Sissom 1986) and fixed finger length/carapace length = 0.64. Although tarsomere II spine counts overlap in the two species, the specimen's count is very near the modal count for *D. ferrugineus*, but is at the upper end of the range for *D. colwelli*. Finally, Cerro Potosí is located in south central Nuevo León very near the localities from which *D. ferrugineus* was taken.

In the course of studying *Diplocentrus* material from Nuevo León, two new records of *D. colwelli* were found. Two females and a very young specimen from Cienega de Flores were taken on 14 June 1941 by H. Dybas; these specimens are deposited in the Field Museum of Natural History, Chicago. A male and two females were also taken 3 mi N Galeana on Rayones Road on 23 July 1975 by E. A. Liner, *et al.*; these specimens are in the Florida State Collection of Arthropods.

Specimens Examined. - MEXICO: Nuevo León, 2.7 mi N and 2.4 mi SE La Ascension on La Caballada Rd., 19 July 1975 (E. A. Liner), 1 holotype male, 1 paratype male, 1 adult? female, 2 juv. females (FSCA); 3 mi N General Ignacio Zaragoza, 19 July 1974 (E. A. Liner, *et al.*), 1 male (FSCA); 1-3.3 mi N General Ignacio Zaragoza, 20 July 1975 (E. A. Liner), 3 juvs. in three vials (FSCA); 0.6 mi S Poterio Prieto in Arroyo Mesquital, 16 July 1974 (E. A. Liner, *et al.*), 1 male (partial specimen) (FSCA); 12.6 mi W, 1.4 mi N Dr. Arroyo on El Pequeño Road, 21 July 1975 (E. A. Liner), 1 juv. (FSCA).

Diplocentrus coylei, NEW SPECIES

(Figs. 8-14)

Type Data. - Adult male holotype from outside Grutas de Cacahuamilpa, Guerrero, Mexico on 8 June 1982 by F. Coyle; deposited in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Etymology. - The specific epithet is a dedication to Dr. Frederick Coyle, who collected the holotype, for his contributions to arachnology.

Distribution. - Known only from northern Guerrero, Mexico.

Comparative Diagnosis. - Two species of the genus *Diplocentrus* have been reported from Guerrero: *D. tehuacanus* Hoffmann and *D. magnus* Beutelspacher & López-Forment. *Diplocentrus coylei* appears most similar to *D. tehuacanus*, but differs in a number of important characters. The anterior margin of the carapace is very finely granular in *D. coylei*, but is granulose in *D. tehuacanus*. In *D. coylei*, the metasomal carinae are stronger, with the dorsolaterals and lateral supramedians distinctly granular. Metasomal segment III bears ten carinae in *D. coylei* (the lateral inframedians are present), but only eight carinae in *D. tehuacanus*. The dorsolateral, lateral supramedian, and ventrolateral carinae of metasomal segment IV are all moderate to strong in *D. coylei*, but are obsolete or vestigial, weak, and smooth in *D. tehuacanus*. Males of *D. coylei* have the dorsal and external surfaces of the pedipalp chelae reticulate, but only the dorsal face bears reticulations in *D. tehuacanus*.

There are also distinctive morphometric differences in the pedipalps and metasoma between the two species, particularly in males. Some ratios demonstrating these differences are as follows (female ratios given in parentheses): pedipalp chela length/depth = 2.81-3.15 (2.10) in *D. coylei*, but is 2.54 (1.92) in *D. tehuacanus*; pedipalp patella length/width = 2.83-3.20 (2.48) in *D. coylei*, but is 2.77 (2.07) in *D. tehuacanus*.

Diplocentrus magnus is a much larger, dark-colored species with adults approximately 100 mm in length. In addition, the tarsomere II spine formula of the legs (4/6-7: 4-5/7: 5-6/7: 5-6/7-8) is quite different from that in *D. coylei*. Adult males of *D. magnus* are currently unknown, so morphometric comparisons with males of *D. coylei* cannot be made.

Description. - Based on holotype male.

Coloration: Base color uniformly orange to orange brown with a fairly strong underlying dusky pattern on carapace and anterior half of each tergite. Carinae of metasoma and pedipalps dark reddish brown. Distal part of pedipalp chela palm and fingers slightly darker orange brown. Proximal segments of legs yellow brown, distal segments yellowish. Venter light yellow brown. Cheliceral manus yellow brown with faint dusky pattern distally; cheliceral teeth dark reddish brown.

Prosoma: Anterior margin of carapace densely, finely granular (Fig. 8); remainder of carapace smooth to finely granular, lustrous. Sternum with single anteromedian seta and nine additional pairs of setae.

Mesosoma: Tergites finely granular, interspersed with sparse coarse granulation posterolaterally. Tergite VII weakly bilobed, granuloreticulate posterolaterally. Genital operculum with four pairs of larger setae along posterior margin and one median pair; microsetae present along posteromedial margins and on genital papillae. Pectinal tooth count 16-15. Sternites III-VI minutely punctate, lustrous, sparsely setose. Sternite VII with submedian and lateral carinae vestigial, weak, and finely granular.

Metasoma: Segments I-IV: Dorsolateral carinae on I-III moderate, irregularly granular; on IV moderate, smooth to granular. Lateral supramedian carinae on I-IV moderate to strong, irregularly granulose. Lateral inframedian carinae on I moderate, irregularly granulose; on II-III moderate, irregularly granular; on IV weak, almost smooth. Ventrolateral carinae on I-II strong, crenulate; on III moderate, crenulate; on IV moderate, irregularly crenulate. Ventral submedian carinae on I-II moderate, irregularly granulose; on III-IV vestigial, weak, granular. Dorsal and lateral intercarinal spaces of I-II granuloreticulate, of III-IV granular. Segment V (Fig. 9): Dorsolateral carinae moderate, smooth. Lateromedian carinae vestigial, weak, smooth. Ventrolateral, ventromedian, and ventral transverse carinae strong, with distinctly enlarged subconical granules. Ratio of segment II length/width = 1.17; III length/width = 1.30; segment V length/width = 2.79.

Telson (Fig. 9): moderately setose.

Chelicerae: Movable finger distinctly shorter than manus length; fixed finger distinctly shorter than manus width.

Pedipalps: Trichobothrial pattern Type C, orthobothriotaxic (Vachon 1974). Femur (Fig. 10): Dorsal and internal faces moderately, coarsely granular; dorsal face flattened throughout. Dorsointernal carina strong, granulose; ventrointernal carina strong, granulose; dorsoexternal carina moderate, irregularly granular; ventroexternal carina obsolete. Ratio of femur length/width = 2.78. Patella (Figs. 11-12): Dorsointernal carina strong, smooth; dorsal median carina vestigial, smooth; dorsoexternal carina weak, smooth; ventroexternal carina moderate, smooth; ventrointernal carina strong, moderately granulose. Internal face with basal tubercle bearing four large granules; distal portion densely, finely granular. Dorsal face weakly, smoothly reticulate. Ratio of patella length/width = 3.20. Chela (Figs. 13-14): Dorsal marginal carina strong, granulose; dorsal secondary carina weak, smooth; digital carina strong, smooth; external secondary carina weak, smooth; ventroexternal carina vestigial, weak at movable finger condyle, smooth; ventromedian carina very strong, smooth; dorsointernal carina vestigial, granular; ventrointernal and internal secondary carinae weak, smooth. Dorsal and external faces of manus moderately, smoothly reticulate throughout. Ratio of chela length/width = 4.83; chela length/depth = 3.15; of fixed finger length/carapace length = 0.85; of movable finger length (normal left side)/chela depth = 1.70.

Legs: Tarsomere II spine formula 4/4 4/5: 5/5 5/5: 5/6 5/6: 6/6 4/5 (count of left leg IV abnormal).

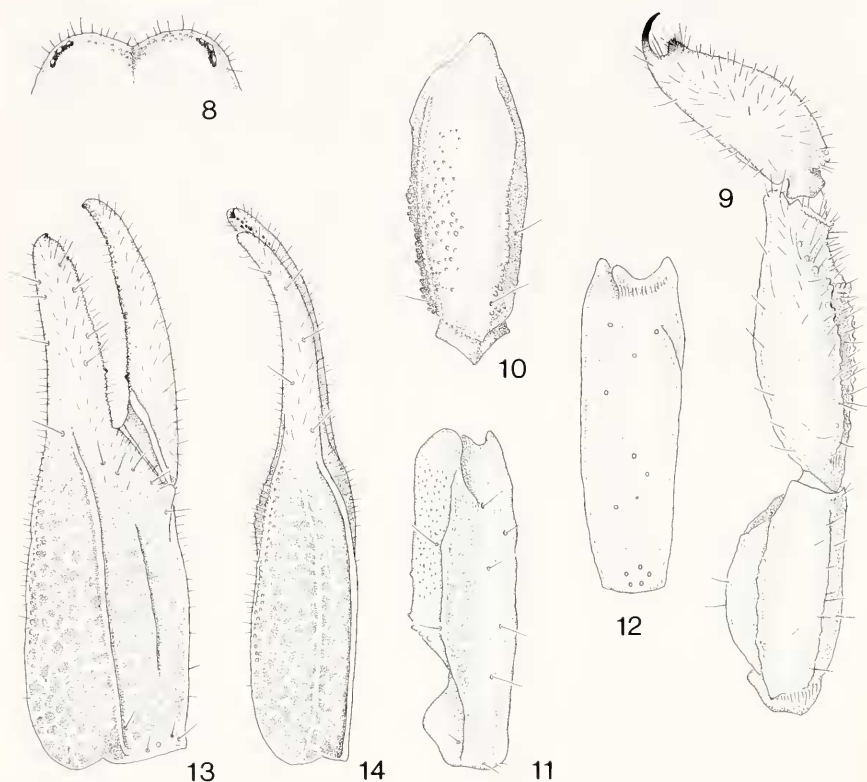
Variation. - The female is similar to the male except in the following characters: (1) the metasomal segments and pedipalpal femur and patella are proportionately shorter, and the chela more robust (Table 1); (2) the dorsal and lateral carinae of the metasomal segments are weaker; (3) the carinae of the pedipalpal chelae are weaker, and the reticulations of the dorsal and external faces are faint; and (4) pectinal tooth counts are lower (see below). As is typical of *Diplocentrus* spp., the young specimens are pale yellow to yellow brown in coloration, but have a distinct dusky pattern on the carapace, tergites, pedipalps, and metasoma; they also have rudimentary carination.

Variation in pectinal tooth counts is as follows: in males there were two pectines with 16 teeth, two with 15 teeth, and two with 14 teeth; in females there were three pectines with 13 teeth, four with 12 teeth, and one with 11 teeth. Morphometric variation is summarized in Table 1, and variation in tarsomere II spine formulas is presented in Table 2.

Measurements. - Holotype male (in mm): Total L, 53.2; carapace L, 6.8; mesosoma L, 17.1; metasoma L, 23.9; telson L, 5.4. Metasomal segments: I L/W, 3.7/3.9; II L/W, 4.1/3.5; III L/W, 4.3/3.3; IV L/W, 5.1/2.9; V L/W, 6.7/2.4. Telson: vesicle L/W/D, 4.4/2.4/1.9; aculeus L, 1.0. Pedipalps: femur L/W, 7.5/2.7; patella L/W, 8.0/2.5; chela L/W/D, 14.5/3.0/4.6; fixed finger L, 5.8; movable finger L, 8.5. Note: The movable finger of the right side is disproportionately longer than on the left side; the measurement for the left movable finger length is 7.8 mm.

Paratype female, Las Granadas (in mm): Total L, 56.5; carapace L, 7.6; mesosoma L, 20.7; metasoma L, 22.5; telson L, 5.7. Metasomal segments: I L/W, 3.4/4.3; II L/W, 3.8/3.9; III L/W, 4.2/3.7; IV L/W, 4.9/3.5; V L/W, 6.2/2.9. Telson: vesicle L/W/D, 4.6/3.0/2.5; aculeus L, 1.1. Pedipalps: femur L/W, 6.1/2.7; patella L/W, 6.7/2.7; chela L/W/D, 13.0/4.6/6.2; fixed finger L, 5.4; movable finger L, 7.7.

Specimens Examined. - MEXICO: Guerrero, Gruta de Cacahuamilpa (W 99.30, N 18.40), 2 Sept 1966 (J. & W. Ivie), 1 juv. (AMNH); outside Gruta de Cacahuamilpa, 8 June 1982 (F. Coyle), 1 holotype male (MCZ); summit, 4 mi W Cacahuamilpa (W 99.34, N 18.41), 3 Sept 1966 (J. & W. Ivie), 1 male, 1 female, 1 juv. (AMNH); Las Granadas, 12 July 1980 (E. Martin & R. García), 1 male, 1 female (AMNH-OFF).



Figs. 8-14. Morphology of *Diplocentrus coylei*, new species. All figures are of holotype male. 8, anterior portion of carapace, dorsal aspect; 9, lateral aspect of metasomal segments IV, V, and telson; 10, dorsal aspect of pedipalp femur; 11, dorsal aspect of pedipalp patella; 12, external aspect of pedipalp patella; 13, external aspect of pedipalp chela; 14, dorsal aspect of pedipalp chela.

Table 1. Ranges in morphometric characters (ratios) of *Diplocentrus ferrugineus*, new species and *D. coylei*, new species. Included herein are additional ratios (not mentioned in the text) that may prove to be of value in separating these species from others in the genus. Only a single female was available for *D. ferrugineus*. Abbreviations are as follows: L = length, W = width, D = depth.

Ratio	<i>D. ferrugineus</i> 3 Males (1 Female)	<i>D. coylei</i> 3 Males (2 Females)
Chela L/W	3.36-3.61 (2.81)	4.17-4.83 (2.83-3.10)
Chela L/D	2.19-2.28 (2.02)	2.81-3.15 (2.09-2.10)
Fixed Finger L/carapace L	0.77-0.88 (0.65)	0.79-0.86 (0.70-0.71)
Movable Finger L/metasma V L	1.09-1.22 (1.11)	1.16-1.21 (1.24-1.26)
Metasoma III L/W	1.21-1.31 (1.07)	1.28-1.32 (1.14-1.18)
Metasoma V L/W	2.30-2.57 (2.04)	2.55-2.79 (2.14-2.23)
Pedipalp Femur L/W	2.35-2.52 (2.22)	2.61-2.78 (2.22-2.26)
Movable Finger L/Chela D	1.35-1.60 (1.21)	1.50-1.70 (1.24-1.26)

Table 2. Variation in tarsomere II spine formulas in *Diplocentrus ferrugineus* and *D. coylei*, new species. A few specimens were missing legs.

<i>D. ferrugineus</i>							
Leg	Spine row	3	4	5	6	7	8
I	Prolateral	1	-	11	1	-	-
	Retrolateral	1	-	8	4	-	-
II	Prolateral	-	-	3	10	-	-
	Retrolateral	-	-	-	10	3	-
III	Prolateral	-	-	1	1	8	1
	Retrolateral	-	-	1	-	7	3
IV	Prolateral	-	-	-	1	10	3
	Retrolateral	-	-	-	-	7	7
<i>D. coylei</i>							
Leg	Spine row	1	2	3	4	5	6
I	Prolateral	1	-	-	8	3	-
	Retrolateral	-	1	-	1	11	-
II	Prolateral	-	-	-	1	12	-
	Retrolateral	-	-	-	-	12	-
III	Prolateral	-	-	-	-	2	12
	Retrolateral	-	-	-	-	-	14
IV	Prolateral	-	-	-	1	-	12
	Retrolateral	-	-	-	-	1	12

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